CSCI2467: Systems Programming Concepts

Class activity: `bash` shell literacy

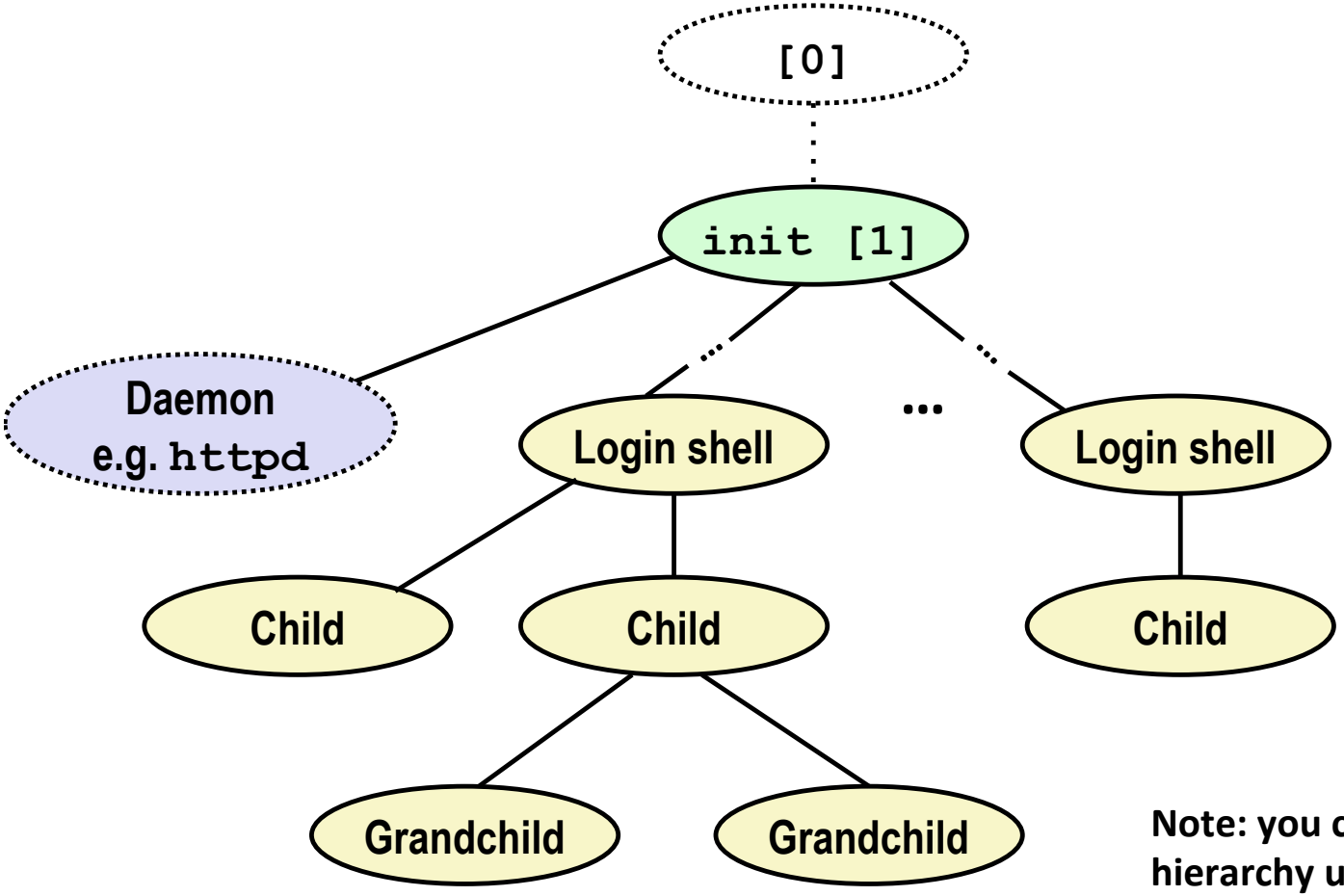
Spring 2020

THE UNIVERSITY of NEW ORLEANS
DEPARTMENT OF COMPUTER SCIENCE

Today

1. Shells
   - History
   - Usage
   - Scripts vs. Programs
2. Bash shell: practical uses for your systems skills
   - Computing your score so far
   - More common tools
3. Activity
   - Make a shell script

Linux process hierarchy



Note: you can view the hierarchy using the Linux `pstree` **command**

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- `tsh` "tiny" shell (you, 2020)

bash is used in many ways

Command processor, or programming language?

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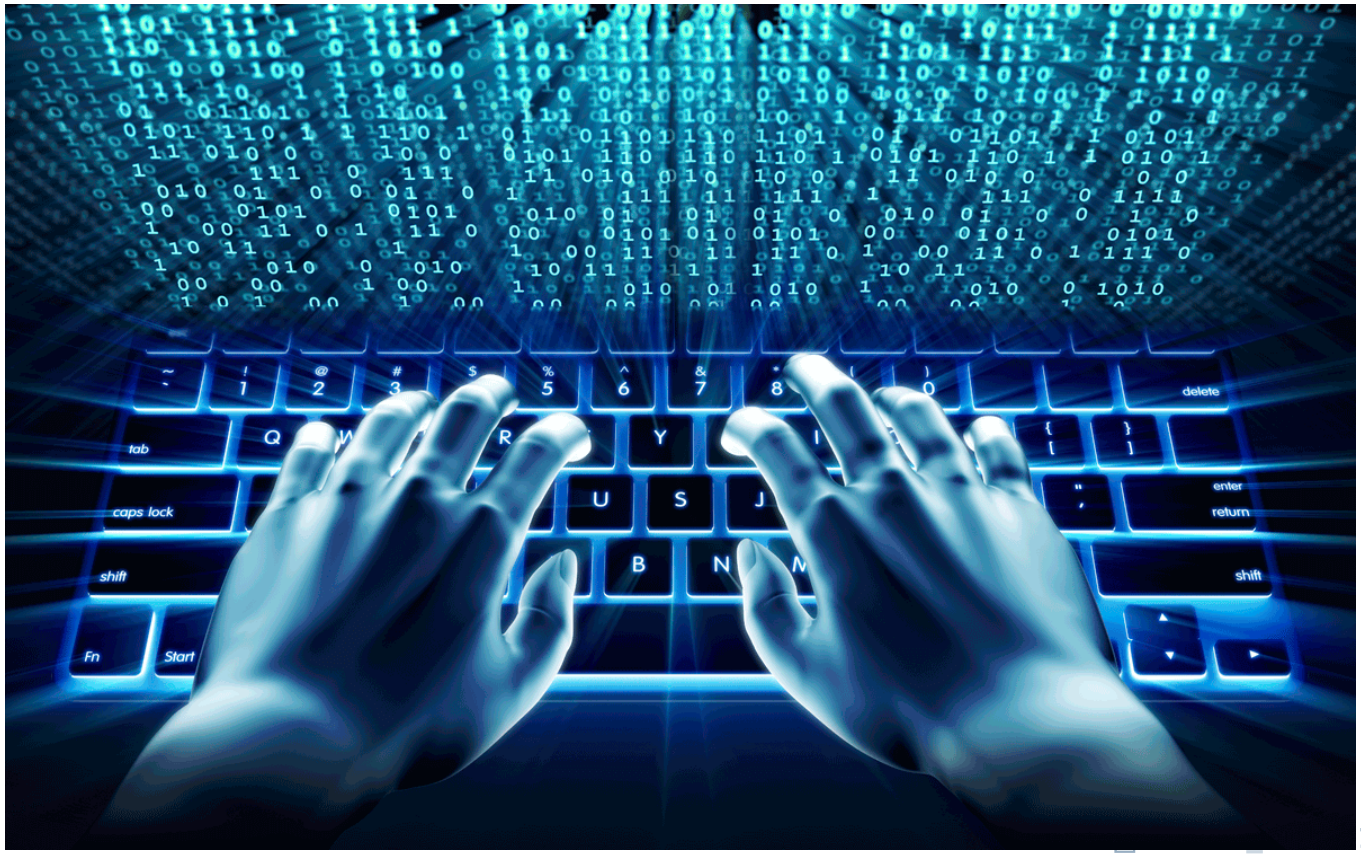
Command processor, or programming language?

Both!

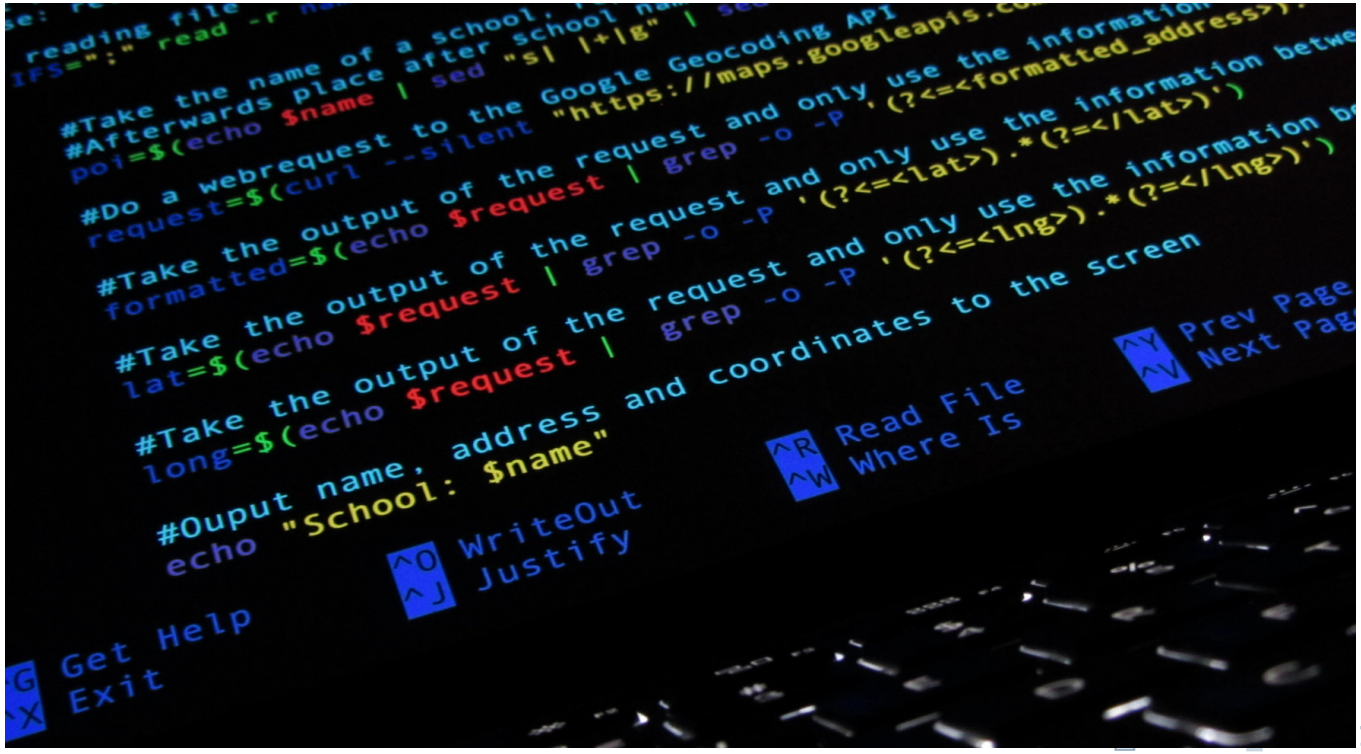
Interactive vs. scripting

- Interactive case: human types commands at a prompt
- You've been using `bash` this way.
- Your `tsh` will work this way.



Interactive vs. scripting

- Shell script: any commands you could type at the shell prompt could also go into a file
  - `bash` then *interprets* that file as a sequence of commands
  - thie file is typically called a `script` (denoted by `.sh` filename extension)



Interactive vs. scripting

`bash` as Command Processor

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`bash` as Programming language

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Script? Program? What's the difference?

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- Scripting languages: bash, perl, python (many more)
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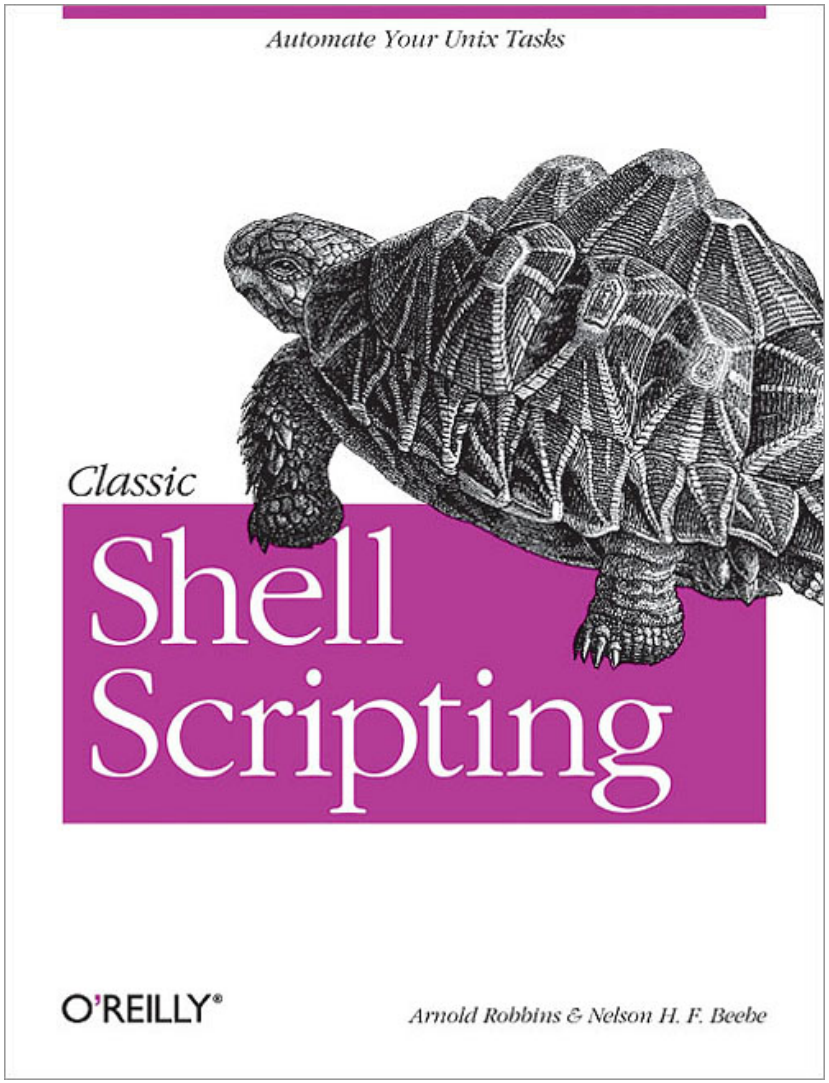
- Traditional programming languages are *compiled*
  - A compiler converts human-readable source code to machine-level instructions (may be called binary or executable)
  - These machine-level instructions are the focus of Chapter 3

Shell scripting



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Your point total

- As usual, log on to terminal in Math 209/212 or via ssh to `systems-lab.cs.uno.edu`

Your point total

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```
$ cat SCORE.* | /home/CSCI2467/sum.sh
```

What did we just do?

No felines were harmed

- `cat` command concatenates files

  output contents of each file given in order

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  /bin/cat:  SCORE.*:  No such file or directory
  ```

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more on wildcards

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- Or, match only certain characters:

  `cat SCORE.lab[01]`

  - matches only `SCORE.lab0` and `SCORE.lab1` (not `SCORE.lab2`) or any others

What did we just do?

more on wildcards

- Try creating a SCORE.lab10 file with:

  `echo 100 > SCORE.lab10`

  - remember *output redirection?*
- Then compare:

  `cat SCORE.lab?`

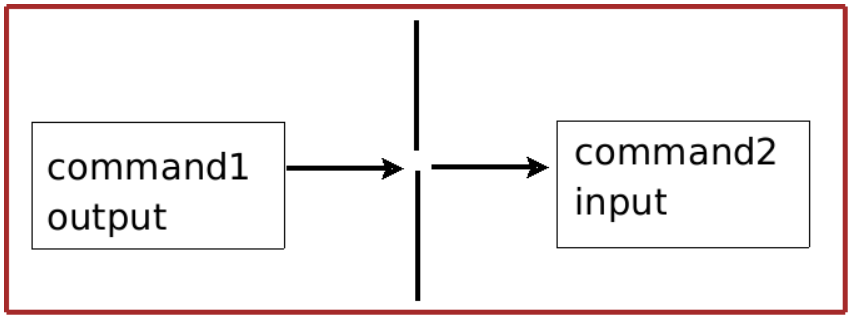
  `cat SCORE.lab??`

  `cat SCORE.lab*`
- Delete `SCORE.lab10` when finished:

  `rm SCORE.lab10`
- Be **very** careful using `*` with `rm` !

What did we just do?

Pipes



- | is called a "pipe"
  - `cmd1` output normally goes to the screen

    ... but instead becomes `cmd2` input (another type of redirection)
  - Then `cmd2` output goes to screen

    ... but *could* be written to a file:

    ```
    cmd1 | cmd2 > outputfile
    ```
- *Many* more examples on Bash redirections cheat sheet

What did we just do?

Shell script example

```
#!/bin/bash

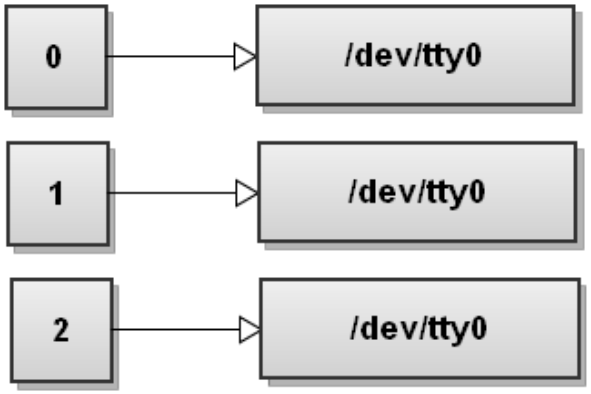
TOTAL=0
while read val; do
        TOTAL=$(($TOTAL+$val))
done
echo $TOTAL
```

- `sum.sh` is a *shell script* (text file)
- commands interpreted by program `/bin/bash`
- would also work if typed in at the prompt:

```
TOTAL=0;
while read val; do TOTAL=$(($TOTAL+$val)); done;
echo $TOTAL
```

What did we just do?

stdin



- `sum.sh` run by itself takes input from keyboard (each number on its own line, end with `CTRL-D`)
- file descriptors 0, 1 and 2 commonly referred to as: `stdin, stdout, stderr`

Images from `http://www.catonmat.net/blog/bash-one-liners-explained-part-three/`

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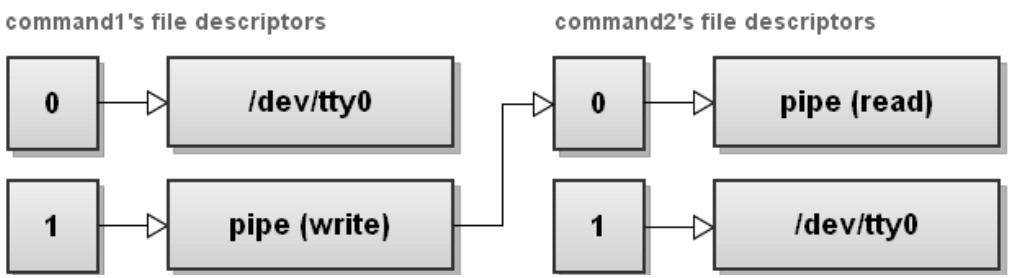

- Thanks to the pipe we used, instead the input to the sum program came from those `SCORE.*` files

  (actually `sum.sh` didn't read files, it read the output of `cat`)
- keeps `sum.sh` program very simple
- Also works with C programs (file descriptors 0 and 1, `open()` and `dup2()`)

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grep: print lines matching a pattern

Make yourself a copy of this example file:

```
cp /home/CSCI2467/labs/bash/lab0-comments .
```

Then run:

```
grep part lab0-comments
```

- strange name, used as noun or verb
- simple and very useful
- example above: find any line containing "part" in file `lab0-comments` (contains several lines)
- case sensitive! try with `Part` instead
- (try with option `-i` for insensitive)
- could write result to a file with:

  ```
  grep Part lab0-comments > mylab0parts
  ```

Pipes make grep even more useful

Pipes make grep even more useful

```
#Take the output of the request and only use the information
long=$(echo $request | grep -o -P '(?<=<lat>).*(?=</lat
#Ouput name, address and coordinates to the screen
echo "School: $name"
echo "Address: $formatted"
echo "Coordinates: $lat , $long"
#Go to sleep for 5 seconds (do
sleep 5
```

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Extra credit opportunity

- Go to AutoLab
- look for extra credit **bash scripting**
- the *writeup* is these slides
  (at the end of the PDF files)
- the *handout* is called `grep.tar`

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  also can be found at:

  `/home/CSCI2467/labs/misc/grep.tar`

Extra credit opportunity

- Add up to 5 points to your point total
- Create a shell script called `secretfinder.sh` which:
  - create a directory called `secretfiles` and change into it
  - extract files from `grep.tar`
  - use `grep` command to find which file contains the SECRET AUTH CODE
  - write the name of that file to a new file called: `authcode.txt`
  - remove the 1000 files tar created (but leave authcode.txt)[1]
  - print "Found the secret auth code! Saved to authcode.txt" to the screen (not to the `authcode.txt` file)
- Hand in your solution (only `secretfinder.sh`) using AutoLab

[1] Again **be careful** with `rm` and see tips on next page

Some tips

- Begin your file (the very 1st line) with `#!/bin/bash`
  - after that you can comment each line using the # symbol
  - put your name and the date in a comment at the top
  - comment subsequent commands
- To extract files use:

  `tar xf grep.tar`
- To delete the 1000 files, use `rm f*==`

  notice how the above command should only delete files that start with "f" and end with "=="

Scoring

- Total 5 points
- 1 point: file is named properly, begins with interpreter line, valid comments for each line
- 1 point: created directory and extracts files
- 1 point: finds AUTH CODE
- 1 point: writes AUTH CODE to correct file
- 1 point: cleans up 1000 files and prints only one line of output.